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ABSTRACT

The annual Survey of Enrollments and Degrees includes 320 degree-granting physics and astronomy departments, 31 of which grant both physics and astronomy degrees. Data are presented on the following areas: physics degrees awarded by academic year, 1968-78; number of institutions by highest physics degree offered, 1978-79; physics enrollments and degrees awarded by academic year 1968-79; undergraduate and graduate enrollments and degrees by institution type, 1968-79; introductory physics enrollments in physics-degree-granting institutions by geographic region, 1978-79; introductory physics enrollments, 1978-79; actual and projected number of undergraduate physics majors; undergraduate physics majors by geographic region and type of institution, 1978-79; full-time and part-time graduate physics enrollment by type of institution, 1978-79; physics degrees by type of institution and geographic region, 1977-78; actual and projected number of physics doctorates granted, 1965-1988; number of physics bachelor's degrees and doctorates granted by sex and minority group status, 1977-78; astronomy enrollments 1978-79 and degrees 1977-78 in separate and combined departments; and astronomy enrollments 1978-79 and degrees 1978-79 by type of institution. (SW)

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ENROLLMENTS AND DEGREES

AIP Pub. No. R-151.16

by Susanne D. Ellis

February 1979

Included in this annual Survey of Enrollments and Degrees are 820 degree-granting physics and astronomy departments, 31 of which grant both physics and astronomy degrees. This series of surveys is now twenty years old and has the distinction of summarizing the data of nearly 100% of these degree-granting departments.

The change in trends that can now be observed in Figure I consists largely of the leveling off of bachelor's degrees and the slowing decline in master's degrees granted. The doctorates are expected to increase slightly in 1979 and remain at approximately 1,000 per year for the next five years, (see Figure III).

TABLE I. Institutions by highest physics degree offered, 1974-79

Academic year	Doctorate granting	Master's granting	Bachelor's granting etc.
1974–75	171	121	559
1975–76	171	118	534
1976–77	173	114	515
1977–78	172	110	508
1978–79	170*	104	502

* *Six of these institutions have two doctorate granting departments; the second one is generally an applied physics department.*

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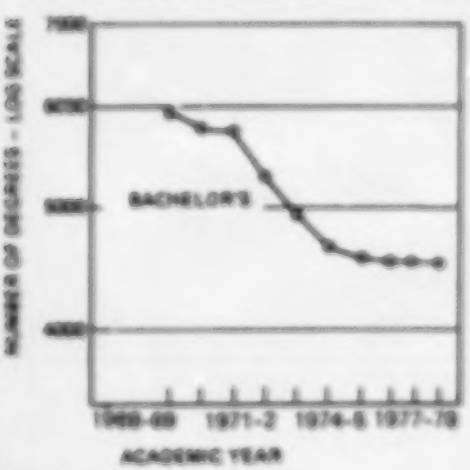
Fig. 1. Physics degrees awarded by academic year 1968-78



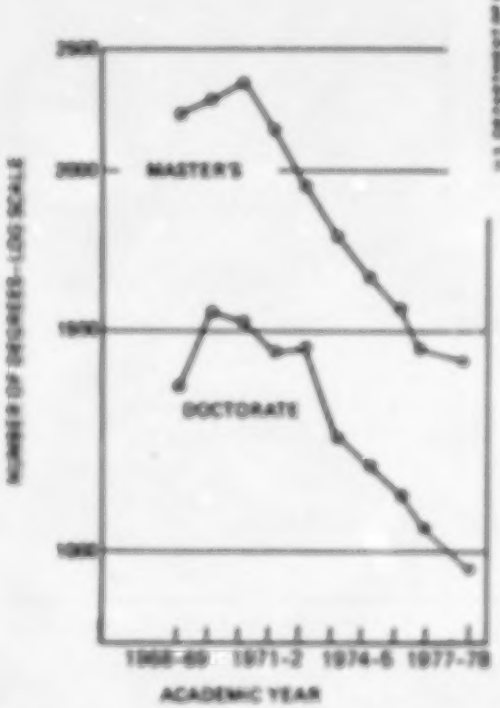


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Table II. Physics enrollments and degrees awarded by academic year 1969–79.

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors	Total	1st year*
1969–69	5575	2223	1356	7587	7019	19475	3899
1969–70	5782	2368	1545	7480	6700	14272	3916
1970–71	5705	2300	1530	6884	6883	14327	3464
1971–72	5382	2143	1436	6583	6182	13216	3236
1972–73	4823	1961	1445	6012	5806	11804	3004
1973–74	4662	1772	1236	5858	5100†	11119	2860
1974–75	4671	1860	1187	5880	4939†	10410	2668
1975–76	4487	1570	1111	5888	4822†	10272	2646
1976–77	4517	1468	1061	5711	4830††	9961	2624
1977–78	4457	1422	971	5830	497511	9835	2499
1978–79				5835	4964	9913	2458

* *Includes part-time students who might be at the 1st-year level for more than one year.*

† *This total has been adjusted by 500 for students who are seniors for more than one year.*

†† *This total has been adjusted by 300 students who are seniors for more than one year.*

Table III. Undergraduate and graduate enrollments and degrees by institution type , 1969–79

Academic year	Number of physics degrees granted (July 1 to June 30)			Undergraduate physics-major enrollment		Graduate physics-student enrollment	
	Bachelor's	Master's	Doctorate	Juniors	Seniors **	Total	1st year
				Doctorate granting institutions			
1969–69	2994	1950	1356	3794	3899	13633	2998
1969–70	3036	1834	1545	3988	3369	12779	3302
1970–71	2988	1917	1530	3510	3490	12490	2958
1971–72	2502	1940	1436	3362	2987	11434	2449
1972–73	2285	1484	1445	2787	2717	10227	2177
1973–74	2155	1387	1236	2844	2484	9758	2189
1974–75	2191	1318	1187	2780	2420	9295	2205
1975–76	2182	1249	1111	2983	2505	9241	2183
1976–77	2184	1186	1051	2952	2502	8957	2182
1977–78	2218	1164	971	2851	2590	8852	2138
1978–79				2837	2579	8864	2107
				Master's granting institutions			
1969–69	1039	273		1335	1270	1842	871
1969–70	1022	484		1281	1274	1593	716
1970–71	1044	483		1230	1175	1927	636
1971–72	983	503		1238	1210	1942	687
1972–73	820	477		1145	1068	1577	727
1973–74	810	385		939	883	1380	511
1974–75	889	332		881	741	1119	463
1975–76	804	321		916	811	1131	483
1976–77	858	283		840	761	1078	442
1977–78	590	258		832	753	983	381
1978–79				795	694	949	351
				Bachelor's granting institutions			
1969–69	1952			2458	2050		
1969–70	1724			2330	2057		
1970–71	1843			2154	1968		
1971–72	1798			2273	1985		
1972–73	1638			2080	2003		
1973–74	1687			2075	1731		
1974–75	1681			1998	1748		
1975–76	1501			1989	1866		
1976–77	1675			2030	1867		
1977–78	1649			2137	1633		
1978–79				2103	1991		

** *These are senior physics major enrollments as of September. For the four academic years 1974–75 through 1977–78 the totals have been adjusted for part-time seniors who would otherwise have been counted as seniors for more than one year.*

Table IV. Introductory physics enrollments in physics-degree-granting institutions by geographic region 1974–79

Geographic region †	1974-75	1975-76	1976-77	1977-78	1978-79
New England	20479	22125	23139	28947	21228
Mid. Atlantic	41882	47981	44919	44839	42052
E.N. Central	49143	52412	50123	51588	50434
W.N. Central	19319	21406	22019	22263	21115
S. Atlantic	35113	37014	36272	38519	33097
E.S. Central	13881	14843	14900	15003	14835
W.S. Central	26168	30089	32956	29368	26768
Mountain	18887	19716	19798	20460	19342
Pacific	30810	34252	34838	32836	32064
Total	255932	279518	277741	284152	261105

†New England—*Conn., Me., Mass., N. Hamp., R.I., Vt.*; Middle Atlantic—*N.J., N.Y., Pa.*; East North Central—*Ill., Ind., Mich., Ohio, Wisc.*; West North Central—*Iowa, Kansas, Minn., Mo., Nebr., N. Dak., S. Dak.*; South Atlantic—*Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W.Va.*; East South Central—*Ala., Ky., Miss., Tenn.*; West South Central—*Ark., La., Okla., Tex.*; Mountain—*Ariz., Colo., Idaho, Mont., Nev., N. Mex., Utah, Wyo.*; Pacific—*Alas., Cal., Hawaii, Oreg., Wash.*

Table II presents the numerical data for Figure I as well as the undergraduate and graduate physics enrollments since 1968. By expanding Table II to distinguish between the three types of physics departments, one obtains Table III. Comparing the enrollment trends for the past decade of the master's institutions with those of the other two types, a shift toward the doctorate-granting institutions seems to have been occurring at the undergraduate level. It is important to call attention to how relatively constant the first-year graduate enrollment has been at the PhD-granting universities, because it is this number that is used in projecting the number of physics doctorates granted five years later.

Having presented a comprehensive summary of physics enrollments in the first three tables of this report, Tables IV through IX focus on a detailed analysis of the physics pipeline.

When compared with other disciplines such as chemistry, engineering or the social sciences, physics attracts a relatively small number of majors. Introductory physics, on the other hand is frequently a required course for engineering majors and thus enrolls over a quarter of a million freshman-sophomore level students.

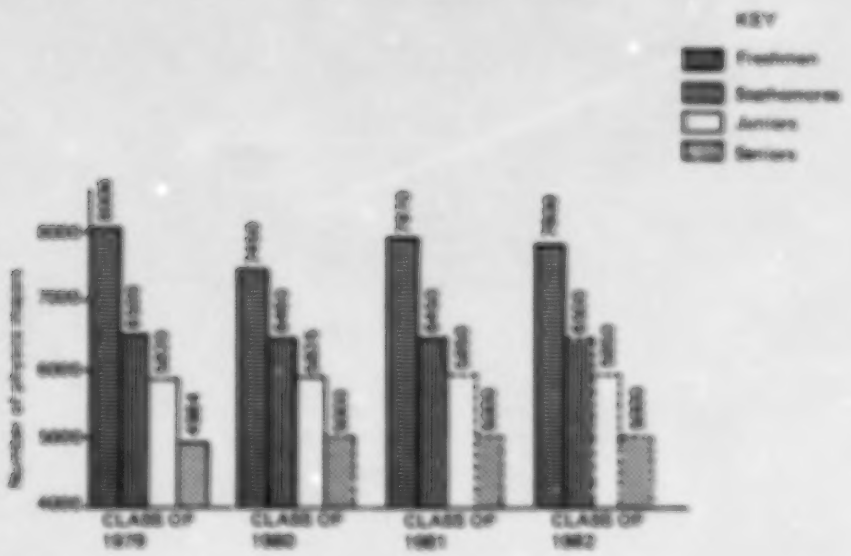
Table IV shows a five-year enrollment trend for each of nine geographic regions. The eight percent decline for 1978–79 could be attributable in part to a higher proportion of engineering majors taking introductory physics in engineering departments instead of physics departments. Table V supports such a statement by showing a decrease from the previous year of 10,000 engineering majors enrolled in physics departments.

Table V. Introductory physics enrollments, 1978–79

Enrollment in introductory physics courses designed for		Institution type* I		II		III		Total	
		N	%	N	%	N	%	N	%
engineering majors		16289	25.1	11588	30.0	58943	37.4	86829	33.2
physical science majors		13329	20.4	5252	13.6	26635	16.9	45216	17.3
biology, health-related majors		20841	31.9	11857	30.7	46483	29.5	79181	30.3
others		14768	22.6	9925	25.7	25531	16.2	50221	19.2
Total introductory enrollment	N	65333	100%	38620	100%	157602	100%	261105	
	%	25.0%		14.8%		60.2%			100%

* "Institution type" indicates the highest degree offered: type I = bachelor's degree, type II = master's degree, type III = doctorate.

Fig. II. Actual and projected number of undergraduate physics majors



With an increasing number of chairmen providing estimates of their prospective physics majors, it became possible for the first time to compute the attrition rates occurring in four years of undergraduate study. Thus the first set of bars in **Figure II** follow the 1975–76 freshman physics majors through four years of undergraduate study to become the graduating class of 1979 physics bachelors. Each cluster of four bars shown in **Figure II**, depict the freshmen, sophomores, juniors and seniors of four successive graduating classes. The most recent estimate of freshman physics majors is that for 1978–79 and added up to 7809. Based on the attrition of earlier classes, 5000 of them are expected to become seniors in 1981–82 and are presented in **Figure II** as the "class of 1982."

Although most physics departments do not require their undergraduates to declare a major until the beginning of the junior year, the large number of courses required to major in physics make an early decision practical. Thus chairmen are in a position to supply estimates of freshman and sophomore level physics majors summarized in **Table VI**.

In recent years the number of seniors appeared to be disproportionately large when compared with the number of students receiving bachelor's degrees at the end of each year. A few spot checks disclosed that some undergraduates remain seniors for more than one year to complete all the requirements for the bachelor's degree. Thus chairmen were asked for the first time in 1978–79 to enter the number of fifth-year undergraduates on the questionnaires. The last column in **Table VI** adds together all those fifth-year undergraduates and shows that they comprise 10% of the senior class.

Table VI. Undergraduate physics majors by geographic region and type of institution, 1978–79.

Geographic region*	Estimated** no. of freshmen	Estimated** no. of sophomores	Number of juniors	Number of seniors	Fifth-year undergraduates
New England	670	618	540	524	26
Mid. Atlantic	1335	1106	985	918	91
E.N. Central	1240	1104	939	915	47
W.N. Central	717	577	470	387	33
S. Atlantic	1133	906	791	679	44
E.S. Central	383	330	221	196	20
W.S. Central	754	578	520	436	41
Mountain	458	432	339	340	69
Pacific	965	887	1031	793	166
Total	7809	6454	5835	4364	493
Doctorate granting inst.	2430	2878	2937	2579	285
Master's granting inst.	1088	876	766	654	83
Bachelor's granting inst.	3381	2700	2103	1691	125

* *See Table IV for explanation of geographic region.*

** *Estimates of potential physics majors made by the physics department chairmen.*

Table VII. Full-time and part-time graduate physics enrollment by type of institution, 1973-79

Academic year	Number of first-year graduate students			Total number of graduate students						
	Institution type*			Institution type*						
	II	III	Total	II			III			
				Full-time	Part-time	Sub-total	Full-time	Part-time	Sub-total	Total
1973-74	511	2189	2880	734	626	1360	9810	948	9758	11118
1974-75	483	2305	2988	623	492	1115	8338	999	9295	10410
1975-76	483	2163	2846	636	503	1121	8439	802	9241	10372
1976-77	442	2182	2824	576	507	1083	8119	780	8936	9991
1977-78	361	2138	2499	546	437	983	8174	679	8852	9835
1978-79	351	2107	2458	468	481	949	8185	679	8864	9813

*Institution type indicates the highest physics degree offered: type II = master's degree, type III = doctorate.

In comparison with other disciplines, physics has a higher proportion of graduate students who study on a full-time basis. Table VII shows that this observation applies only to the enrollment at PhD-granting institutions. The graduate enrollment at master's institutions in recent years is essentially divided equally between full-time and part-time students.

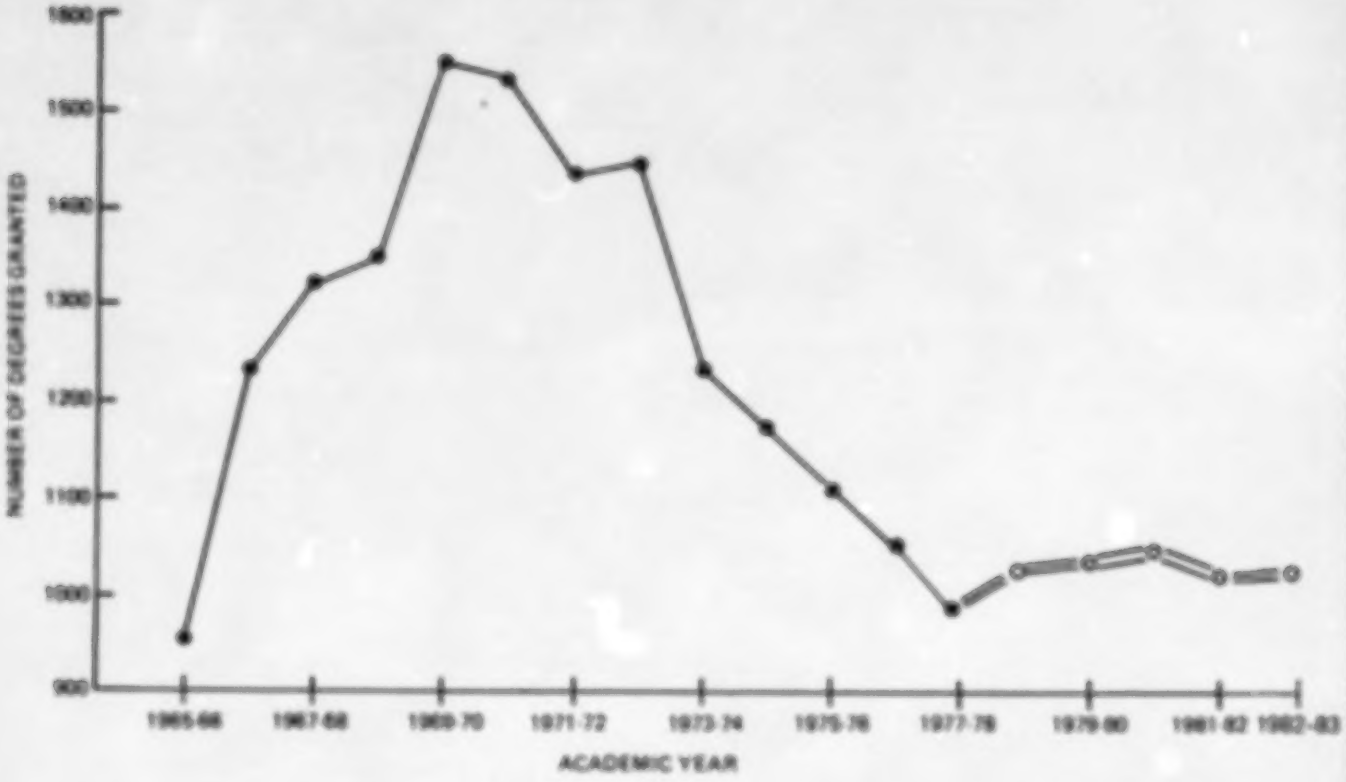
Table VIII offers details of where physics degrees are granted and by what types of institutions. Unlike the trend tables at the beginning of this report, Table VIII distinguishes between degree recipients who enter the job market with a master's degree and those who are granted master's degrees enroute to a higher degree. While one would expect the latter group to be enrolled at PhD-granting institutions, there exists a small number of masters (85 in the class of 1978) who transfer from master's institutions to larger universities and continue their studies toward a PhD. It may be of interest to note that terminal master's degrees declined more rapidly than master's degrees enroute to higher degrees, in the 1970's, (a decline of 40% for the former compared with 28% for the latter, since 1971).

Table VIII. Physics degrees by type of institution and geographic region, 1977-78.

Geographic region*	Bachelor's degrees			Master's degrees			Terminal master's degrees		Doctorates
	Institution type**			Institution type**			Institution type**		Institution type**
	I	II	III	II	III		II	III	III
New Engla. d	162	22	391	1	85		1	77	140
Mid. Atlantic	339	64	435	7	160		20	76	195
E.N. Central	306	146	381	33	111		54	123	165
W.N. Central	107	76	117	4	30		28	22	42
S. Atlantic	236	58	245	11	42		36	51	97
E.S. Central	60	51	73	2	10		4	17	23
W.S. Central	119	43	142	9	35		18	38	60
Mountain	45	9	202	2	39		1	39	54
Pacific	196	122	357	7	131		31	58	196
Subtotal	1849	590	2218	65	727	862	193	502	971
Total		4457				1422		695	971

* See Table IV for explanation of geographic region.
** Institution type indicates the highest physics degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.

Fig. III. Actual and projected number of physics doctorates granted 1965–1983.



The median number of years of graduate study to complete a physics doctorate is five, with a range from three to more than ten years. As mentioned in connection with Table III, the number of physics doctorates granted each year correlates well with the number of first-year graduate students enrolled at PhD-granting institutions five years earlier. Also, as the number of first-year students decreased, a larger percentage of them eventually received doctorates. Back in the mid-1960's when there were 2600 first-year graduate students instead of 2100, less than 40% of them completed their doctoral studies. But as this total declined to 2100, 45% of them are granted doctorates. The flat portion of Figure III reflects the leveling of first-year graduate enrollment.

A frequent request for information is the one dealing with the proportion of women and minorities among physics degree recipients. While department chairmen contribute some of these data, a large proportion of Table IX is based on reports from individual graduates. The table identifies seven minority groups, the members of which received bachelor's degrees or doctorates in physics in 1977–78. The last three of the seven groups listed include mostly foreign citizens some of whom return to their native countries. Noticeable among the minority groups is the higher proportion of women.

Table IX. Number of physics bachelor's degrees and doctorates granted by sex and minority group status, 1977–78.

Type of degree	Sex	Total no. of degrees	Total minorities	Minority groups						
				Blacks	Am. Ind.	Puerto Rican	Mex. Am.	Other Latin Am.	Asian Ind.	Oriental
Bachelor's degrees	Men	4042	156	60	7	2	8	12	5	62
	Women	415	19	10	0	1	0	0	1	7
	Total	4457	175	70	7	3	8	12	6	69
Doctorates	Men	905	90	8	3	2	1	8	16	52
	Women	66	13	1	0	0	0	1	1	10
	Total	971	103	9	3	2	1	9	17	62

ASTRONOMY

Five years ago the scope of the Survey of Enrollments and Degrees was extended to include astronomy data, and last year a thorough classification of the degree-granting astronomy departments was made to determine the highest astronomy degree granted by each, and whether the department is combined with a physics department or functions separately.

While it may still be too early to obtain a clear picture of the direction taken by the trends in astronomy degrees, it helps to single out consistently reporting astronomy departments and examine their degree production. Figure IV represents the degree production of 56 consistent contributors. Only the number of astronomy doctorates granted since 1973-74 appear to increase somewhat; the bachelor's and master's degree production remained relatively stable.

Tables X and XI focus on the degree recipients of the class of 1978 and the 1978-79 astronomy enrollments; the totals in both tables are the same, but the astronomy departments are classified differently. Table X divides the departments into separate astronomy departments and those combined with physics departments, while Table XI groups the astronomy departments with respect to the highest astronomy degree granted.

Fig. IV Trend in astronomy degrees granted, 1973-78

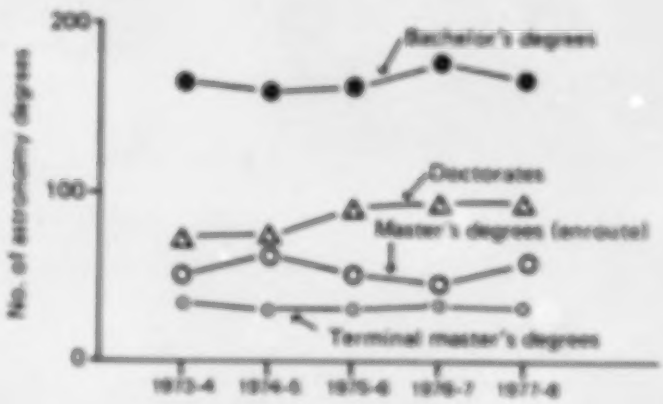


Table X. Astronomy enrollments 1978-79 and degrees 1977-78 in separate and combined departments

			38 separate astronomy departments	31 combined astronomy and physics departments	69 astronomy departments
1977-78 ASTRONOMY DEGREES					
Bachelor's			131	46	177
Master's			60	4	64
Terminal master's			29	2	31
Doctor's			79	14	93
1978-79 ASTRONOMY ENROLLMENTS					
Introductory courses	for science majors		1754	956	2710
	for nonscience majors		24527	6111	30638
	Subtotal		26281	7067	33348
	Astronomy offered in physics departments		–	–	58872
	Total introductory enrollment				92220
Undergrad majors	Juniors		192	78	270
	Seniors		178	70	248
Graduate students	First-year	U.S.	108	18	126
		Foreign	13	6	19
		Total	121	24	145
	Total graduate students	Full-time	553	114	667
		Part-time	36	7	43
		Total	589	121	710

Table XI. Astronomy* enrollments 1978–79 and degrees 1977–78 by type of institution*

		Type I		Type II		Type III		Total	
No. of depts.	Combined	16		3		12		31	
	Separate	5		4		28		38	
	Total	20		7		42		69	
Astronomy degrees 1977–78		Men	Women	Men	Women	Men	Women	Men	Women
	Bachelor's	24	9	14	0	114	16	152	25
	Master's	–	–	5	0	50	4	60	4
	Terminal master's	–	–	3	1	23	4	28	5
	Doctor's	–	–	–	–	66	5	66	5
Astronomy enrollments 1978–79	Introd. courses for science majors	953		131		1827		2710	
	Introd. courses for nonscience majors	3811		1408		25421		30639	
	Introd. courses offered in physics departments	—		—		—		58672	
	Total introductory enrollments							92020	
	Junior astronomy majors	49		33		188		270	
	Senior astronomy majors	37		33		179		249	
	First-year graduate students	–		7		138		145	
	Total graduate students	–		33		677		710	

* *This survey includes only degree-granting astronomy departments.*

** *"Institution type" indicates the highest astronomy degree offered; type I = bachelor's degree, type II = master's degree, type III = doctorate.*

A supplement to this report is a complete listing of all 69 astronomy departments with enrollment and degree information specified for each.

Additional publications available from the Manpower Statistics Division are:

Graduate Student Survey
Employment Survey
Survey of Physics and Astronomy Bachelor's Degree Recipients